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ABSTRACT:

PROBLEM TO BE SOLVED: To provide a diversity receiver where a diversity effect is not deteriorated even when two antennas with different gains are used.

SOLUTION: The receiver is provided with a high gain antenna A, a low gain antenna B, a reception section 4 that demodulates a received signal and detects a reception level, and a threshold discrimination section 5 that compares the reception level with the selected switching threshold. In the case the high gain antenna A is connected, since an expected value of an improved amount is lower by the gain difference even when other low gain antenna B is selected, the switching threshold (threshold 1) lower by the difference is set. In the

case the low gain antenna B is selected conversely, since the improved amount
after the switching is high, a higher threshold (threshold 2) by the improved
value is set. In the case that the reception level is smaller than the
selected switching threshold, a changeover control section 6 selects the
antennas A, B and the thresholds.

reception level < threshold

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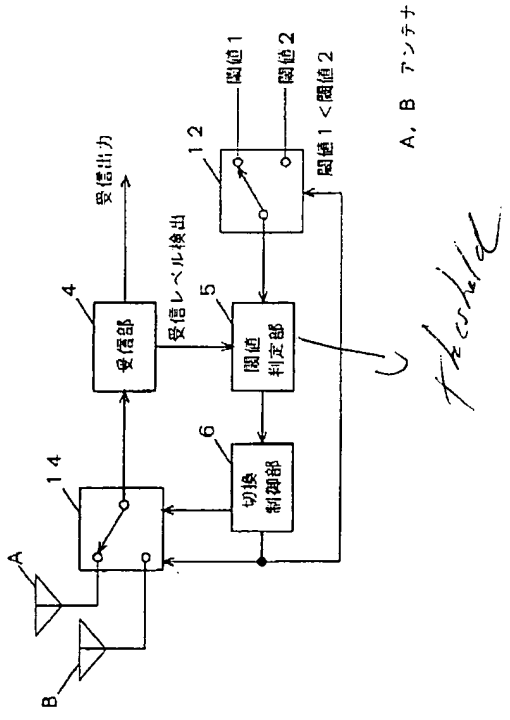
(54)【発明の名称】　ダイバーシチ受信装置

(57)【要約】

【課題】　異なる利得の２本のアンテナを用いた場合でも、ダイバーシチ効果の劣化しないダイバーシチ受信装置を提供することを目的とする。

【解決手段】　高利得のアンテナＡと低利得のアンテナＢ、受信信号の復調と受信レベルの検出を行う受信部４、受信レベルと選択されている切換閾値との大小比較を行う閾値判定部５を備える。切換閾値は利得の高いアンテナＡが接続されている場合には、他方の低利得アンテナＢに切り換えても改善量の期待値が利得差分だけ低いため、その分だけ低い切換閾値（閾値１）が設定され、逆に利得の低いアンテナＢに接続された場合には、切換後の改善量が高いのでその分だけ高い切換閾値（閾値２）を設定する。受信レベルが選択されている切換閾値よりも小さい場合には切換制御部６にて、アンテナＡ，Ｂの切換と閾値の切換を行う。



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【特許請求の範囲】

【請求項1】複数本のアンテナと、受信レベルを検出する受信レベル検出手段と、前記受信レベルと所定の切換閾値とのレベル比較を行う閾値判定手段と、前記閾値判定手段において受信レベルが閾値よりも低ければアンテナ及び切換閾値を切り換える切換制御手段とを備えたことを特徴とするダイバーシチ受信装置。

【請求項2】アンテナ毎に平均受信レベルを記憶する記憶手段を備え、この記憶手段のレベル差に応じて前記切換閾値を適応的に可変設定することを特徴とする請求項1記載のダイバーシチ受信装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、移動体通信におけるダイバーシチ受信装置に関するものである。

【0002】

【従来の技術】近年PHS、携帯電話等、移動体通信に対するニーズが高まっているが、移動体通信においてはフェージングによる受信感度劣化対策が重要な問題となっている。従来からダイバーシチ受信装置はフェージングによる受信感度劣化に有効な方法として用いられているが、アンテナ切換ダイバーシチ受信は構成が容易な方式として知られている。以下に従来のダイバーシチ受信装置について説明する。図4は従来のダイバーシチ受信装置のブロック図、図5は、従来のダイバーシチ受信装置を用いた場合の受信レベルの変動図を示すものである。図4において、1は受信信号の復調と受信レベルを検出する受信部であり、2は前記受信レベルと所定の閾値の大小比較を行う閾値判定部である。このダイバーシチ受信装置は2本のアンテナA，Bを有している。14はアンテナ切換部である。受信レベルが閾値よりも低ければ、切換制御部3にてアンテナを切り換える。図5において、aはアンテナAの受信レベル、bはアンテナBの受信レベル、太線は選択されているアンテナの受信レベルである。

【0003】

【発明が解決しようとする課題】しかしながら、上記従来の方法および構成では、2本のアンテナA，Bの利得が異なる場合にはダイバーシチ効果が劣化するという問題点を有している。

【0004】本発明は上記従来の問題点を解決するもので、異なる利得の2本のアンテナを用いた場合でも、ダイバーシチ効果の劣化しないダイバーシチ受信装置を提供することを目的とする。

【0005】

【課題を解決するための手段】本発明は、複数本のアンテナと、受信レベルを検出する受信レベル検出手段と、前記受信レベルと所定の切換閾値とのレベル比較を行う閾値判定手段と、前記閾値判定手段において受信レベルが閾値よりも低ければアンテナ及び切換閾値を切り換える切換制御手段とを備えた。

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【0006】そしてこの構成により、異なる利得の2本のアンテナを用いた場合でも、ダイバーシチ効果の劣化しないダイバーシチ受信装置を実現できる。

【0007】

【発明の実施の形態】請求項1に記載の発明は、複数本のアンテナと、受信レベルを検出する受信レベル検出手段と、前記受信レベルと所定の切換閾値とのレベル比較を行う閾値判定手段と、前記閾値判定手段において受信レベルが閾値よりも低ければアンテナ及び切換閾値を切り換える切換制御手段とを備えた。そしてこの構成によれば、従来1つであった切換閾値を2つ設け、利得の高いアンテナが接続されている場合には他方の低利得アンテナに切り換えても改善量の期待値が利得差分だけ低いため切換閾値をその分だけ低く設定し、低利得アンテナに接続されているときには切換後の改善量が高いので切換閾値を高く設定することにより、2本のアンテナが異なる利得の場合にはダイバーシチ効果を改善できる。

【0008】請求項2に記載の発明は、アンテナ毎に平均受信レベルを記憶する記憶手段を備え、この記憶手段のレベル差に応じて、切換閾値を適応的に可変設定するようにした。そしてこの構成によれば、ダイバーシチ利得をより改善できる。

【0009】（実施の形態1）図1は本発明の実施の形態1のダイバーシチ受信装置のブロック図を示すものである。図1において、4は受信部であり、受信信号の復調と受信レベルの検出を行う。5は閾値判定部であり、前記受信レベルと選択されている切換閾値との大小比較を行う。12は閾値切換部である。このダイバーシチ受信装置は、2本のアンテナA，Bを備えているが、このうち一方のアンテナAは高利得、他方のアンテナBは低利得である。切換閾値は利得の高いアンテナAが接続されている場合には、他方の低利得アンテナBに切り換えても改善量の期待値が利得差分だけ低いため、その分だけ低い切換閾値（閾値1）が設定され、逆に利得の低いアンテナBに接続された場合には、切換後の改善量が高いのでその分だけ高い切換閾値（閾値2）を設定する。受信レベルが選択されている切換閾値よりも小さい場合には切換制御部6にて、アンテナA，Bの切換と閾値の切換が行われる。

【0010】図2は本発明の実施の形態1のダイバーシチ受信装置を用いた場合の受信レベルの変動図である。図5の従来のダイバーシチ受信装置を用いた場合には切換閾値が同じであるため、利得の高いアンテナAの受信レベルが高いにも関わらず、利得の低いアンテナBで受信している場合が多く見られるが、図2のように、利得の低いアンテナBの切換閾値を高く設けることにより、低い利得のアンテナBで受信することが少なくなり、より高い受信レベルでの受信を行うことができる。

【0011】（実施の形態2）また、図3は本発明の実

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施の形態２のダイバーシチ受信装置のブロック図である。図３において、７は受信部であり、受信信号の復調と受信レベルの検出を行う。８ａ、８ｂは各々の平均受信レベルメモリであり、前記受信レベルの平均値をアンテナ毎に記憶する。９は閾値設定部であり、前記平均受信レベルメモリに各々記憶されている値のレベル差に応じて、閾値１、閾値２を可変設定する。１０は閾値判定部であり、前記受信レベルと選択されている切換閾値との大小比較を行う。１２は閾値切換部、１３はメモリ切換部である。受信レベルが選択されている切換閾値よりも小さい場合には切換制御部１１にて、アンテナＡ，Ｂの切換と閾値の切換が行われる。

【００１２】

【発明の効果】以上のように本発明によれば、複数本のアンテナの利得が異なることによるダイバーシチ効果の劣化を改善でき、受信感度劣化の少ないダイバーシチ受信装置を実現できる。

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【図面の簡単な説明】

【図１】本発明の実施の形態１のダイバーシチ受信装置のブロック図

【図２】本発明の実施の形態１のダイバーシチ受信装置を用いた場合の受信レベルの変動図

【図３】本発明の実施の形態２のダイバーシチ受信装置のブロック図

【図４】従来のダイバーシチ受信装置のブロック図

【図５】従来のダイバーシチ受信装置を用いた場合の受信レベルの変動図

【符号の説明】

Ａ，Ｂ　アンテナ

４，７　受信部

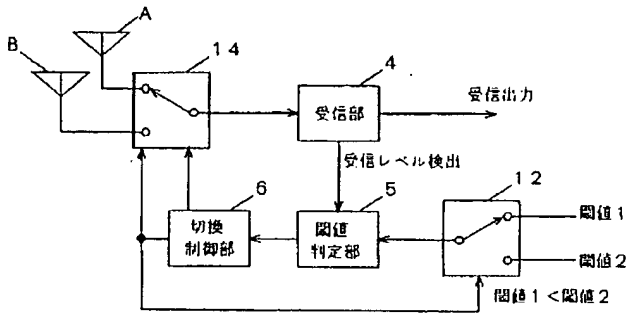
５，１０　閾値判定部

６，１１　切換制御部

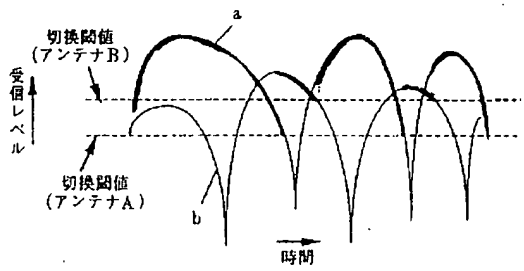
８ａ，８ｂ　平均受信レベルメモリ

９　閾値設定部

【図１】

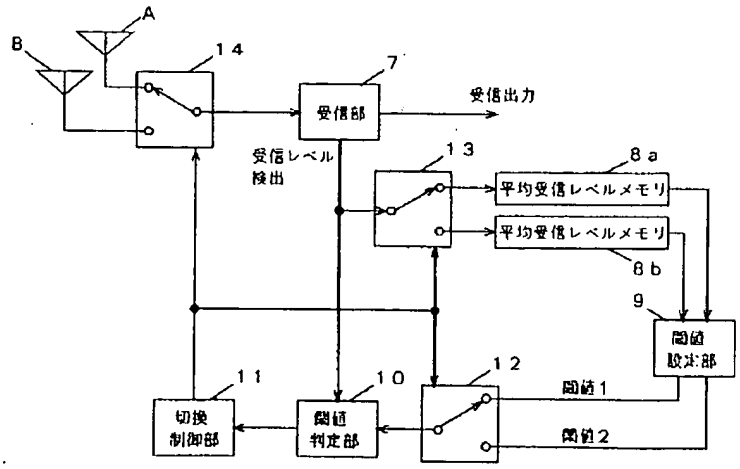


【図２】

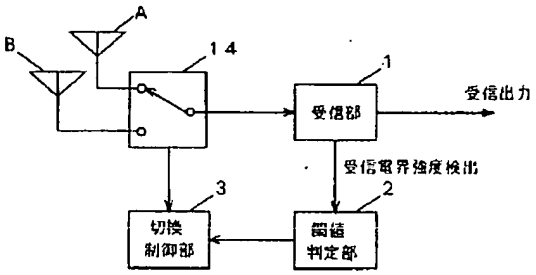


A，B　アンテナ

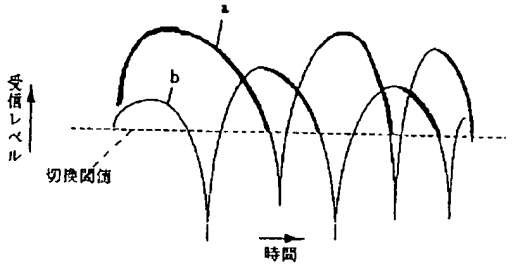
【図３】



【図4】



【図5】



JP10022706

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the diversity reception equipment in mobile communications.
[0002]
[Description of the Prior Art] Although the needs to mobile communications, such as PHS and a cellular phone, are increasing, in mobile communications, it has been a problem with the important cure against receiving sensibility degradation by phasing in recent years. Although diversity reception equipment is used as an approach effective in receiving sensibility degradation by phasing from the former, antenna change-over diversity reception is known as a method with an easy configuration. Conventional diversity reception equipment is explained below. The fluctuation Fig. of receiving level when conventional diversity reception equipment is used for the block diagram of the diversity reception equipment of the former [drawing 4] and drawing 5 is shown. In drawing 4 , 1 is a receive section which detects a recovery and receiving level of an input signal, and 2 is the threshold judging section which performs the size comparison of said receiving level and a predetermined threshold. This diversity reception equipment has two antennas A and B. 14 is the antenna change-over section. If receiving level is lower than a threshold, an antenna will be switched by the change-over control section 3. In drawing 5 , it is the receiving level of the antenna with which the receiving level of Antenna A is chosen for a, and the receiving level of Antenna B and a thick wire are chosen for b.
[0003]
[Problem(s) to be Solved by the Invention] However, with the approach and configuration of the above-mentioned former, when the gains of two antennas A and B differ, it has the trouble that the diversity effectiveness deteriorates.
[0004] This invention solves the above-mentioned conventional trouble, and even when two antennas of different gain are used, it aims at offering the diversity reception equipment with which the diversity effectiveness does not deteriorate.
[0005]
[Means for Solving the Problem] This invention was equipped with two or more antennas, a receiving level detection means to detect receiving level, a threshold judging means to perform the level comparison with said receiving level and a predetermined change-over threshold, and the change-over control means that will switch an antenna and a change-over threshold if receiving level is lower than a threshold in said threshold judging means.
[0006] And even when two antennas of different gain are used by this configuration, the diversity reception equipment with which the diversity effectiveness does not deteriorate can be realized.
[0007]
[Embodiment of the Invention] Invention according to claim 1 was equipped with two or more antennas, a receiving level detection means to detect receiving level, a threshold judging means to perform the level comparison with said receiving level and a predetermined change-over threshold, and the change-over control means that will switch an antenna and a change-over threshold if receiving level is lower than a threshold in said threshold judging means. Since only difference is low, only that part sets up a change-over threshold low. and -- when according to this configuration two change-over thresholds which were one conventionally are established and the high antenna of gain is connected, even if it switches to the low interest profit antenna of another side -- the expected value of the amount of improvements -- gain -- The diversity effectiveness can be improved when it is the gain from which two antennas differ by setting up a change-over threshold highly, since the amount of improvements after a change-over is high when connecting with the low interest profit antenna.
[0008] Invention according to claim 2 is equipped with a storage means to memorize average receiving

level for every antenna, and was made to carry out an adjustable setup of the change-over threshold accommodative according to the level difference of this storage means. And according to this configuration, diversity gain is more improvable.

[0009] (Gestalt 1 of operation) Drawing 1 shows the block diagram of the diversity reception equipment of the gestalt 1 of operation of this invention. In drawing 1 , 4 is a receive section and performs recovery of an input signal, and detection of receiving level. 5 is the threshold judging section and performs the size comparison with said receiving level and the change-over threshold chosen. 12 is the threshold change-over section. Although this diversity reception equipment is equipped with two antennas A and B, the antenna B of high interest profit and another side of one antenna A is low interest profit. when the high antenna A of gain is connected, even if it switches a change-over threshold to the low interest profit antenna B of another side -- the expected value of the amount of improvements -- gain -- since only difference is low, when a low change-over threshold (threshold 1) is set up and only the part is conversely connected to the low antenna B of gain, since the amount of improvements after a change-over is high, only the part sets up a high change-over threshold (threshold 2). When smaller than the change-over threshold as which receiving level is chosen, by the change-over control section 6, a change-over of Antennas A and B and a change-over of a threshold are performed.

[0010] Drawing 2 is the fluctuation Fig. of the receiving level at the time of using the diversity reception equipment of the gestalt 1 of operation of this invention. Although the receiving level of the high antenna A of gain is high and many cases where the low antenna B of gain has received are seen since the change-over threshold is the same when the conventional diversity reception equipment of drawing 5 is used, like drawing 2 , by establishing highly the change-over threshold of the low antenna B of gain, receiving with the antenna B of low gain decreases, and reception on higher receiving level can be performed.

[0011] (Gestalt 2 of operation) Drawing 3 is the block diagram of the diversity reception equipment of the gestalt 2 of operation of this invention again. In drawing 3 , 7 is a receive section and performs recovery of an input signal, and detection of receiving level. 8a and 8b are each average receiving level memory, and memorize the average of said receiving level for every antenna. 9 is the threshold setting section and carries out an adjustable setup of a threshold 1 and the threshold 2 according to the level difference of the value respectively memorized by said average receiving level memory. 10 is the threshold judging section and performs the size comparison with said receiving level and the change-over threshold chosen. 12 is the threshold change-over section and 13 is the memory change-over section. When smaller than the change-over threshold as which receiving level is chosen, by the change-over control section 11, a change-over of Antennas A and B and a change-over of a threshold are performed.

[0012]

[Effect of the Invention] As mentioned above, according to this invention, degradation of the diversity effectiveness by the gains of two or more antennas differing can be improved, and diversity reception equipment with little receiving sensibility degradation can be realized.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Although the needs to mobile communications, such as PHS and a cellular phone, are increasing, in mobile communications, it has been a problem with the important cure against receiving sensibility degradation by phasing in recent years. Although diversity reception equipment is used as an approach effective in receiving sensibility degradation by phasing from the former, antenna change-over diversity reception is known as a method with an easy configuration. Conventional diversity reception equipment is explained below. The fluctuation Fig. of receiving level when conventional diversity reception equipment is used for the block diagram of the diversity reception equipment of the former [drawing 4] and drawing 5 is shown. In drawing 4 , 1 is a receive section which detects a recovery and receiving level of an input signal, and 2 is the threshold judging section which performs the size comparison of said receiving level and a predetermined threshold. This diversity reception equipment has two antennas A and B. 14 is the antenna change-over section. If receiving level is lower than a threshold, an antenna will be switched by the change-over control section 3. In drawing 5 , it is the receiving level of the antenna with which the receiving level of Antenna A is chosen for a, and the receiving level of Antenna B and a thick wire are chosen for b.

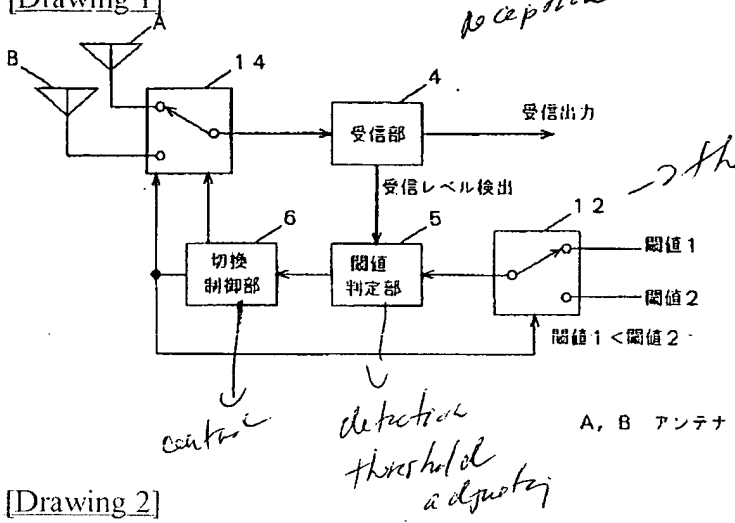
[Means for Solving the Problem] This invention was equipped with two or more antennas, a receiving level detection means to detect receiving level, a threshold judging means to perform the level comparison with said receiving level and a predetermined change-over threshold, and the change-over control means that will switch an antenna and a change-over threshold if receiving level is lower than a threshold in said threshold judging means.
[0006] And even when two antennas of different gain are used by this configuration, the diversity reception equipment with which the diversity effectiveness does not deteriorate can be realized.
[0007]
[Embodiment of the Invention] Invention according to claim 1 was equipped with two or more antennas, a receiving level detection means to detect receiving level, a threshold judging means to perform the level comparison with said receiving level and a predetermined change-over threshold, and the change-over control means that will switch an antenna and a change-over threshold if receiving level is lower than a threshold in said threshold judging means. Since only difference is low, only that part sets up a change-over threshold low. and -- when according to this configuration two change-over thresholds which were one conventionally are established and the high antenna of gain is connected, even if it switches to the low interest profit antenna of another side -- the expected value of the amount of improvements -- gain -- The diversity effectiveness can be improved when it is the gain from which two antennas differ by setting up a change-over threshold highly, since the amount of improvements after a change-over is high when connecting with the low interest profit antenna.
[0008] Invention according to claim 2 is equipped with a storage means to memorize average receiving level for every antenna, and was made to carry out an adjustable setup of the change-over threshold accommodative according to the level difference of this storage means. And according to this configuration, diversity gain is more improvable.
[0009] (Gestalt 1 of operation) Drawing 1 shows the block diagram of the diversity reception equipment of the gestalt 1 of operation of this invention. In drawing 1 , 4 is a receive section and performs recovery of an input signal, and detection of receiving level. 5 is the threshold judging section and performs the size comparison with said receiving level and the change-over threshold chosen. 12 is the threshold change-over section. Although this diversity reception equipment is equipped with two antennas A and B, the antenna B of high interest profit and another side of one antenna A is low interest profit. when the high antenna A of gain is connected, even if it switches a change-over threshold to the low interest profit antenna B of another side -- the expected value of the amount of improvements -- gain -- since only difference is low, when a low change-over threshold (threshold 1) is set up and only the part is conversely connected to the low antenna B of gain, since the amount of improvements after a change-over is high, only the part sets up a high change-over threshold (threshold 2). When smaller than the change-over threshold as which receiving level is chosen, by the change-over control section 6, a change-over of Antennas A and B and a change-over of a threshold are performed.
[0010] Drawing 2 is the fluctuation Fig. of the receiving level at the time of using the diversity reception equipment of the gestalt 1 of operation of this invention. Although the receiving level of the high antenna A of gain is high and many cases where the low antenna B of gain has received are seen since the change-over threshold is the same when the conventional diversity reception equipment of drawing 5 is used, like drawing 2 , by establishing highly the change-over threshold of the low antenna B of gain, receiving with the antenna B of low gain decreases, and reception on higher receiving level can be performed.
[0011] (Gestalt 2 of operation) Drawing 3 is the block diagram of the diversity reception equipment of the gestalt 2 of operation of this invention again. In drawing 3 , 7 is a receive section and performs recovery of an input signal, and detection of receiving level. 8a and 8b are each average receiving level memory, and memorize the average of said receiving level for every antenna. 9 is the threshold setting section and carries out an adjustable setup of a threshold 1 and the threshold 2 according to the level difference of the value respectively memorized by said average receiving level memory. 10 is the threshold judging section and performs the size comparison with said receiving level and the change-

over threshold chosen. 12 is the threshold change-over section and 13 is the memory change-over section. When smaller than the change-over threshold as which receiving level is chosen, by the change-over control section 11, a change-over of Antennas A and B and a change-over of a threshold are performed.

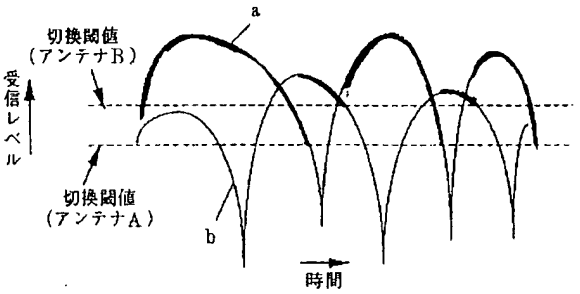
[Translation done.]

DRAWINGS

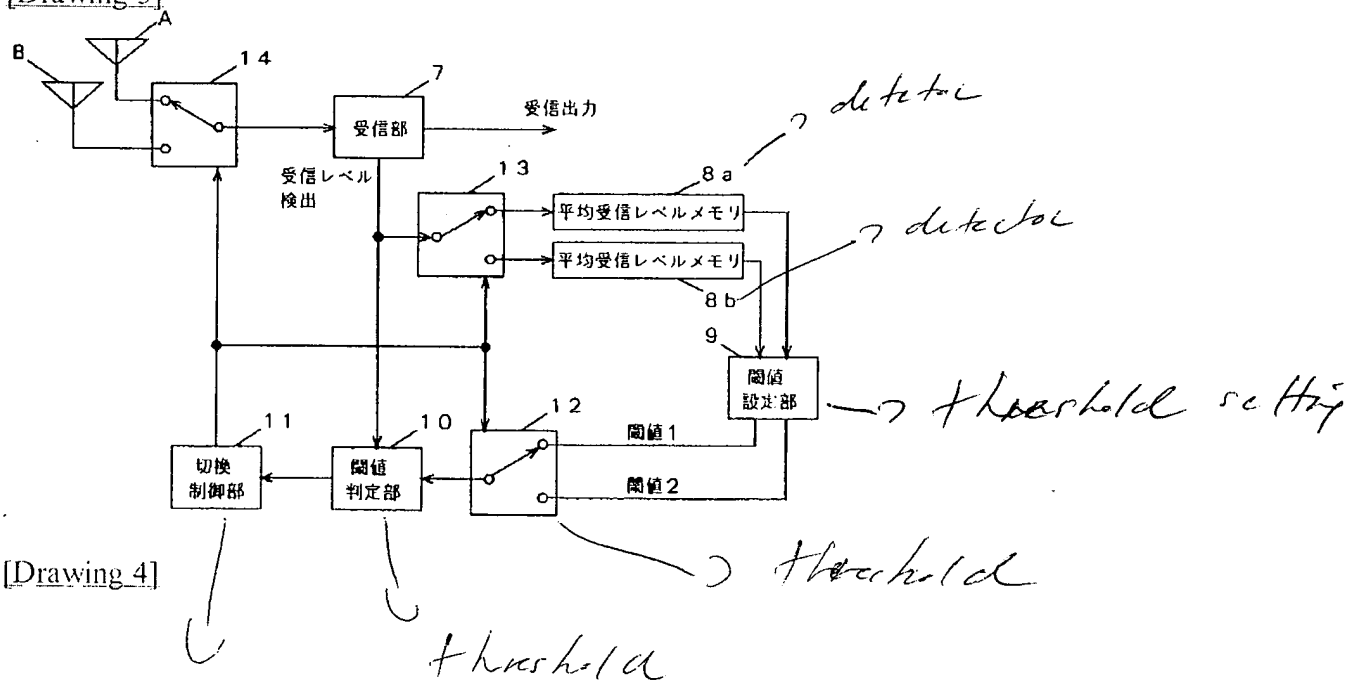
[Drawing 1]



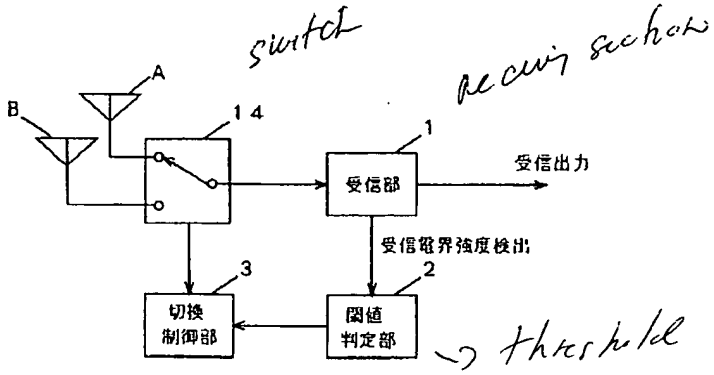
[Drawing 2]



[Drawing 3]

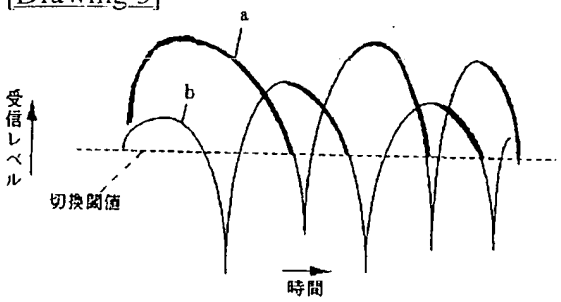


[Drawing 4]



switch
recev section
→ threshold adjust (compare recev level with prediction level

[Drawing 5]



[Translation done.]